



1R 1793

30 October 2008

Application Number 10/590,409  
Art Unit: 1793

Examiner: Vanessa T. Velasquez

Dear Ms Velasquez

Further to my letter of 19 September, I have rewritten claim 1 to emphasise the subject matter, which the applicant regards as the invention. The focus is on continuous treatment of liquid scrap in vacuum desorbers.

The published US Patent Application in paragraph [0083] outlines measures to be taken to preclude sub-surface nucleation and growth of CO bubbles, resulting in explosive disintegration of the liquid steel being admitted to the vacuum chamber 24. These include, firstly use of control rods 47 to maintain adequate depth or "ferrostatic" head in the conductively heated strip of liquid steel 45 undergoing conductive heating without explosive disintegration. Secondly, "also shown is the low-level liquid metal sump 26 into which the down flow of liquid steel products is accommodated, in this example by an upleg from the reduced pressure desorber 24 in order to induce melt circulation by RH action between the vacuum desorber 24 and the low-level sump 26, which is maintained close to atmospheric pressure. This melt circulation is to combat perceived difficulties in withdrawing continuously the relatively small product flowrate of liquid steel in the face of possible excessive carbon monoxide evolution, which may occur if a single offtake without melt circulation were used, as discussed more fully elsewhere in the description of this invention. It is now clear that paragraph [0083] must be a major contributor to satisfy the requirements of 35 U.S.C. 112, second paragraph. Paragraph [0083] points out distinctly subject matter, which the applicant considers his invention. Further elaboration in the Example re-enforces this contention.

Attention is particularly drawn to the discussion [0111] "Continuous refining of steel under reduced pressure in the afore-mentioned relatively sophisticated systems is inherently beset with the same fundamental problems that have foiled attempts to introduce continuous steelmaking at atmospheric pressure many times in the past." Viable solutions offered by the applicant surely must be considered inventive.

Some notice must also be taken of the assertion lower down in [0111] that "The problem is exacerbated under reduced pressure, so although counter-current gas treatment of metallurgical melts has been patented by the applicant in UK Patent GB 2 193 957 B, molten steel is not a quiescent melt of the type referred to in this former patent, which was directed at inactive melts, such as molten copper sulphide matte containing harmful impurities such as arsenic, antimony, bismuth and lead."

Furthermore, as outlined in [0112] "The problems with attempting to effect in-line continuous vacuum degassing of molten steel based on a steel flow equivalent to the desired steel production rate without massive recirculation of the molten steel have been well-documented in accounts of British Iron and Steel Research Association (BISRA) unsuccessful bid during the early 1960's to commercialize such a process." Solving this

long-standing problem must surely be considered inventive. The very fact that no viable process has previously been proposed for truly continuous vacuum refining of steel is clear evidence that the approach outlined by the applicant must constitute inventiveness. You mistakenly state in 7 "Therefore, it would have been obvious to one of ordinary skill in the art to refine steel contaminated with elements such as zinc, tin and copper ....)" This statement is totally erroneous.

In addition, you state that GB '975 teaches counter current gas treatment for removing volatile impurities.... and the process described by GB '975 is not limited to copper matte and can be applied to remove volatile impurities in other metallurgical melts (page 2, col. 2, lines 94-95). In making this statement you have overlooked that fact that steel contains dissolved carbon and oxygen, which under vacuum conditions causes explosive disintegration of the steel, making continuous removal of the melt from the vacuum chamber in which treatment is carried out absolutely impossible, unless the inventive steps outlined by the applicant are closely adhered to. Clearly the misinformation contained in your assertion in 8 page 8 "it would furthermore have been obvious to a person of ordinary skill to repeat or arrange in series the apparatus of GB '975 into a series of purification columns so that each impurity is removed in series (i.e., one after the other) resulting in a ultra pure material" is naive to say the least. Such an approach without the inventive steps outlined by the applicant would merely complicate the issue and no steel metal product whatsoever would flow through the columns in series.

On your page 6, sub-section 7, your statement that "Warner does not specify the specific impurities in the scrap steel that is refined" is totally incorrect. There is absolutely no basis for you to introduce Grott (U.S. 3,529,067). Again on page 7 you incorrectly state "Warner does not disclose removing specific impurities such as zinc, copper and tin". I find this assertion totally incomprehensible.

Tom et al. relates to drying gaseous hydrogen halides with scavenger compounds in the solid state. The method in the original claim 10 involved contacting pyrolysis gases evolved during scrap preheating with a spray of liquid aluminum droplets followed then by further gas/liquid contacting in a trickle irrigated packed bed employing a fuse salt scrubbing medium. This definitely is not covered in the Tom et al. patent and would not be obvious to one skilled in the art.

As a former Research Manager with Imperial Smelting Corporation in the U.K., who were the principal operators of the zinc/lead blast furnace, referred to worldwide as the Imperial Smelting Furnace (ISF), I can assure you that an ISF condenser does not conserve heat nor contribute to energy conservation. Therefore, I most definitely challenge your assessment concerning the obviousness of the original claim 11.

I dispute your criticism of "high intensity" and "commercially proven". These terms are used throughout industry. I do not accept that usage of these terms renders a claim ambiguous and unclear. Accordingly, I have retained their usage in the amended claim 4.

Also "high pressure steam" is so widely used and understood in power generation that no ambiguity is introduced by retaining such terminology in the context of the amended claim 5.

The draft amended claims submitted in my letter of 19 September have now been rewritten to take into further account your criticism that the original claims were replete with terminology

rendering the claims ambiguous and unclear. The new claims included in this communication attempt to rectify these concerns as far as possible. However, for complex phenomena in steelmaking, involving the interaction of thermodynamics, chemical kinetics, transport of heat and diffusional mass transfer, it is not always possible to effect complete attainment of absolute states or values.

Please find enclosed amended claims to take the place of the draft claims submitted with my letter dated 19 September 2008.

Also in response to Specification Objection (your page 2), I enclose a corrected copy of the original page 20 in which the typographical error referred to has been corrected.

The redundant phase under the heading Claims Objection at the bottom of your page 2 is no longer included.

I have also taken particular care to remove material from the claims that you point out has been anticipated by Warner ("Conductive heating and melt circulation in pyrometallurgy").

Yours sincerely

A handwritten signature in cursive script that reads "Noel Warner".

Dr. Noel A Warner  
Emeritus Professor